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Applicant (s) *SE*

(21) *Patentansökningsnummer* *0201102-1*
Patent application number

(86) *Ingivningsdatum* *2002-04-10*
Date of filing

Stockholm, 2003-04-11

För Patent- och registreringsverket
For the Patent- and Registration Office

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Method in a Communication Network

FIELD OF THE INVENTION

The present invention relates to a method for positioning support of user equipments in a communication network, e.g. a WCDMA-based communication network.

BACKGROUND OF THE INVENTION

There is a tendency to design modern communication networks as distributed systems, which inter alia implies a distinction between network resources on the one hand and communication connections on the other hand. Resources may refer to, e.g., the various hardware components that are applied, and, for CDMA-based communication systems, the transmission power level and channelisation codes. In such systems it is a common case that different logical as well as physical units are in control of different parts of the network. One unit is, e.g. responsible for the control of a communication connection while another unit is responsible for the control of the resources that said communication connections uses. This will now be illustrated by means of figure 1. The figure shows a part of a UMTS Terrestrial Radio Access Network (UTRAN) 10, which can serve as an example of a distributed network as described above. Radio Network Controllers (RNC) 11a,11b perform the control of communication connections and network resources and are responsible to provide connections to the Core Network 15. The Radio Network Controllers 11a,11b are connected to Node-B:s 12a,12b, each controlling a number of cells. Due to the distinction mentioned above, the RNC can take various roles: Regarding network resources, the RNC 11b acts as a

controlling RNC (C-RNC) that is responsible for the control of resources of a part of said network including a number of cells 13b,13c, each of which serving a plurality of user equipments 14b. Regarding the communication connections, an RNC 11a,11b acts as the serving RNC (S-RNC) for those connections that have been set up to or from user equipments 14a,14b, which were located in the area for which this RNC functions as the controlling RNC. However, when a user equipment 14a moves during an ongoing communication from a first RNC 11a, which is the serving RNC for the corresponding communication connection, to a neighboured RNC 11b, the original RNC 11a still remains the serving RNC for this connection while the second RNC 11b, which is in control of the resources that this connection uses, takes the role of a drift RNC (D-RNC) that supports the serving RNC 11a with the necessary radio resources; however, without any influence on said connection.

It is one important task of a communication network 10 to keep track on the position of the user equipments 14a,14b that are served by said network 10. A comparatively simple solution for this task is to apply the cell-ID, more precisely the geographical area information that is related to this cell-ID, to retrieve the location of the user equipment. This implies that the location of a user equipment 14b can be determined by means of identifying the cells 13b,13c, or one of the cells, where the user equipment 14b is currently located and that this information is associated with a geographical area description of this cell, i.e. the coverage area of the cell is mapped on geographical coordinates. The signalling support for this method is in place over the Iur-interface in UTRAN, while it is assumed that for the Iub-interface such signalling support is no needed as each C-RNC should have deep knowledge of the cells under its control.

A more advanced solution would be to adopt more complex positioning methods for the user equipments, e.g. OTDOA or A-GPS.

SUMMARY OF THE INVENTION

It has been observed to be a problem that a serving RNC (S-RNC) cannot get sufficient positioning information of a user equipment that has roamed during an ongoing connection to a second RNC, which provides network resources for said user equipment, while the serving RNC still has the control of the connection of said user equipment.

It is a further problem that positioning information for user equipments that only relies on the cell-ID is too vague and may imply disadvantages for services where a more exact locating of a user equipment is required.

Therefore, it is a first object of the present invention to achieve a method for providing an improved positioning information of user equipments that are located in the cell of a communication network where the adoption of more complex positioning methods is not considered to be appropriate.

It is a second object of the present invention to achieve a method for providing such positioning information to an appropriate network controller unit, e.g. a serving RNC that does not longer provide network resources for said user equipment.

Briefly, these objects are accomplished by the method according to the present invention providing additional cell portion geographical area information to the serving RNC of a user equipment. Said additional information can be

retrieved, e.g., from information of the beam within a cell, within which the user equipment is currently located.

It is a first advantage of the present invention that the accuracy of the positioning of a user equipment within a cell can be increased by comparatively easy means.

It is another advantage of the present invention that the additional information can reuse design efforts that already have been invested for mapping of a cell-ID to a geographical area.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, reference is made to the following drawings and preferred embodiments of the invention.

Figure 1 shows a part of a UMTS Terrestrial Radio Access Network (UTRAN) as an example of a distributed network.

Figure 2a illustrates a first embodiment of the present invention.

DETAILED DESCRIPTION

The present invention builds on the principal idea to provide sufficient additional information to a S-RNC in order to achieve a more accurate positioning of a user equipment compared to the cell-ID based positioning method. Messages that are sent from the D-RNC to the S-RNC, e.g. the

Radio Link Setup Response, the Radio Link Addition Response, or Uplink Signalling Transfer messages, do not only contain a Cell Geographical Area Identifier (GAI) but additionally a Cell Portion Geographical Area Identity that is defined in a similar way as the current GAI and allows a more accurate positioning of the user equipment when applied together with said GAI. A more accurate positioning implies thus a reduction of the area within which the user equipment is located. The additional identifier shall contain information that allows the S-RNC to retrieve a more detailed geographical area description. It is also possible to signal more than one Cell Portion GAI per cell.

One embodiment to achieve this additional information is to apply the concept of beamforming antennas, which bases on an array of antennas that are used to form one or several beams within the cell and each antenna having controlled beam directions. The scope of this beamforming concept is to achieve a better radio resource management, e.g. to increase system capacity.

The following describes some concepts related to beamforming: The user equipment can be instructed to use three different phase references for the downlink dedicated physical channels: the Primary Common Pilot Channel (P-CPICH), which is broadcasted over the entire cell, a secondary Common Pilot Channel (S-CPICH), which may be broadcasted only over a part of the cell, i.e. there may be zero, one or several S-CPICH:s per cell, or dedicated pilots, i.e. a phase reference that is transmitted within the downlink dedicated physical channels. In case of beamforming, independent from being the phase reference for the beams a S-CPICH or dedicated pilots, fixed or flexible beams can be used. When fixed beams are used the coverage area of the beams are fixed. When flexible beams are used, a beam could, e.g., follow a user equipment.

A solution in which only the Node-B is impacted could possibly look as follows:

The Node-B estimates the gain that can be achieved by beamforming and indicates higher resource availability to the C-RNC at system initialisation. The admission/congestion control of the C-RNC would be based on these high resource availability figures. There is no problem as long as the distribution of the user equipments is sufficiently random over the different beams. However, when the distribution of the user equipments becomes less optimal, the Node-B might have to adjust the expectations of the C-RNC. This could be achieved, e.g., by indicating a lower DL-power capability to the C-RNC and possibly adjusting the consumption laws.

Then, when the Node-B establishes a radio link, it will at first always establish it in the sector beam, i.e. a beam covering the whole cell, and in a next step, when it has received information regarding the strongest directed beam, it could move the user equipment to this beam.

In a first embodiment of the present invention the concept of beamforming antennas is adopted in such a way that the S-RNC will know in which beam of a certain cell the user equipment is located, even when the user equipment is using radio resources controlled by another RNC. As the beam coverage is selective, the S-RNC could identify the position of a user equipment to be in one specific beam that can be characterised by a number of geographical location points. The S-RNC can distinguish the different beams by means of the different phase references provided by S-CPICH:s or by dedicated pilots. Apparently, the accuracy will increase for smaller beam coverage areas, i.e. the accuracy depends on the number of beams per cell. Figure 2a shows an example of a cell 20 comprising a Radio Base Station 21 and 8 beams 23 each of which covering 1/8 of the cell. Thus, compared to the solution according to the state-of-the-art that only

bases the positioning on the cell-ID, the present invention can locate a user equipment 22 in an area 23 that is 8-times less than the cell area 20. It is one advantage of the solution according to this embodiment that it is comparatively easy to implement. It is another advantage of this solution that the design effort that already has been invested for cell planning, including a mapping of each cell with a geographical area identity in order to achieve the geographical coordinates of the cell, can be reused for the planning of the beam coverage areas by means of using the same planning tools.

The principal idea of the present invention is to provide additional information that can be used by the S-RNC to identify a reduced area within which the user equipment is located when the Iur-interface is deployed. Thus, the higher accuracy can be achieved by means of signalling support over the Iur-interface, i.e. adding a new information element to the RNSAP-protocol in those cases where the user equipment has resources controlled by a drift RNC (D-RNC) and these are either the only resources or the resources with the best quality.

In general, the method according to the present invention can be applied for any kind of positioning support and is thus not restricted to the above mentioned embodiment. Instead, the inventive method can be modified within the scope of the claims to be applicable in conjunction with other ways of defining appropriate cell portions. The cell portion is an area provided by the D-RNC, which could have it preconfigured or dynamically calculated where information on said cell portion is transmitted over the Iur-interface without the S-RNC ordering any measurement to the D-RNC.

The method according to the present invention can be used as a starting point for positioning support that gives better accuracy compared to the cell-ID based method but without

increasing complexity where said initial measurement can then be refined, if necessary, by more complex methods, e.g. OTDOA or A-GPS.

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CLAIMS

1. Method in a communication network (10) for determining the position of a user equipment (14a,22) that is located within a cell (13b,20), which is covered by a Radio Base Station (21) and distinguishable by means of a cell identity that corresponds to a certain geographical area information,

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retrieving additional geographical area information of a cell portion (23,24) within which the user equipment (22) is located,

providing said geographical area information to a network unit that does not have information on said cell at its disposal.

2. The method according to claim 1, whereby the cell portion (23) consists of the beam that is formed by one the antennas of the Radio Base Station (21) that covers said cell.

3. The method according to claim 2, whereby each beam in a cell can be distinguished by means of a phase reference provided by a pilot channel or by dedicated pilots contained in a downlink dedicated physical channel.

4. The method according to claim 3, whereby the pilot channel is the Secondary Common Pilot Channel (S-CPICH).

5. The method according to one of claims 2-4, whereby the information on the beam is mapped on an information of location points that describe the geographical coordinates of said beam.

6. The method according to claim 1, whereby the cell portion (24) consists of an area that extends from the Radio Base

Station (21) to the cell border under a detected angle of arrival of the user equipment (22).

7. The method according to one of the claims 1-7, whereby the communication network (10) comprises a first and a second interconnected controller unit (11a,11b), each of which acting as a resource controlling unit and a connection controlling unit, whereof the first controller unit (11a) acts as a connection controlling unit of a user equipment (14a) that uses resources that are controlled by the second controller unit (11b), which does not control said connection, and whereby the retrieved additional geographical area information of a cell portion (23,24) within which said user equipment (22) is located is forwarded from the second controller unit (11b) to the first controller unit (11a).

8. The method according to claim 7, whereby the communication network (10) consists of a WCDMA-system comprising a serving RNC as the first controller unit (11a) and a drift RNC as the second controller unit (11b).

9. A signal that is forwarded from a drift RNC to a serving RNC in a WCDMA-based communication network (10),

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additional geographical area information of a cell portion consisting of a beamforming area (23) formed by one the antennas of the Radio Base Station (21) that covers the cell (20) within which the user equipment (22) is located.

ABSTRACT

The present invention relates to a method for positioning support of user equipments in a communication network, e.g. a WCDMA-based communication network. The method according to the present invention provides additional cell portion geographical area information to the serving RNC of a user equipment, which can be retrieved, e.g., from information of the beam within a cell, within which the user equipment is currently located.

Figure for publication: Figure 1

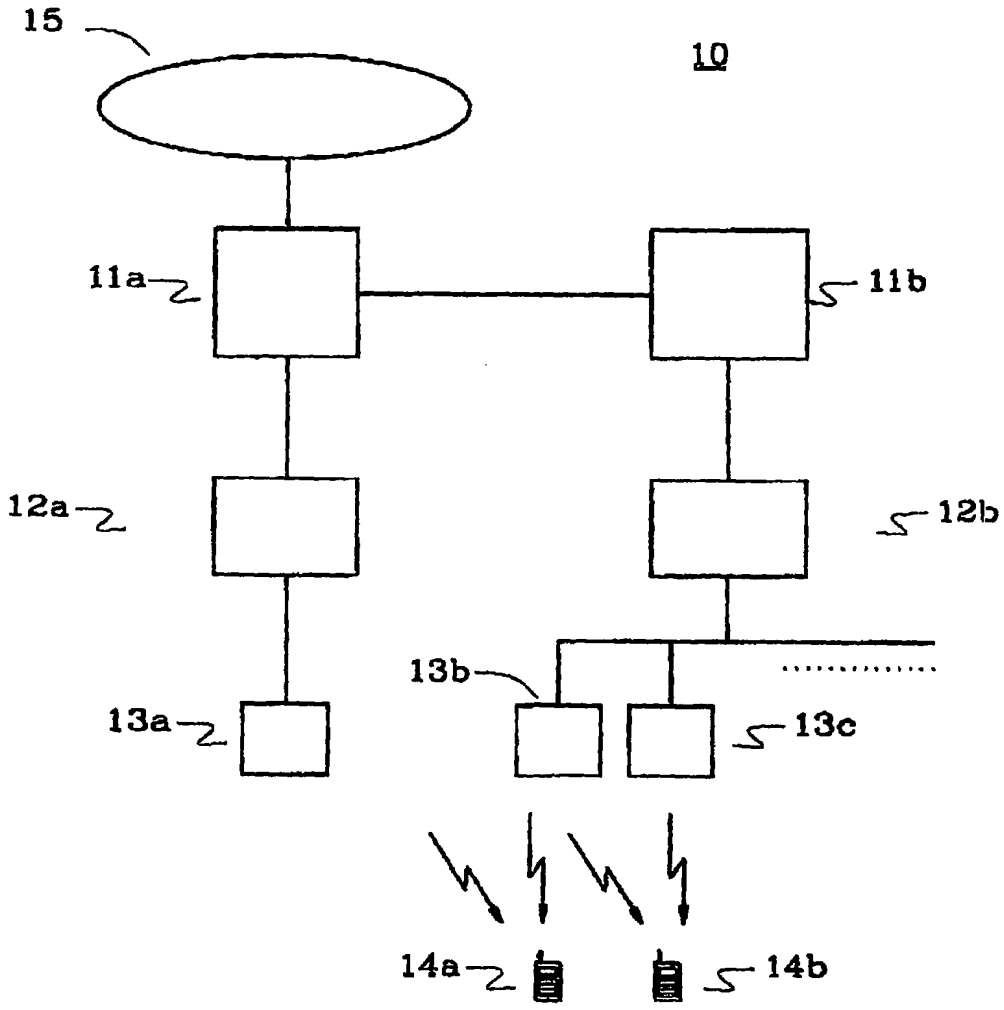

Fig. 1

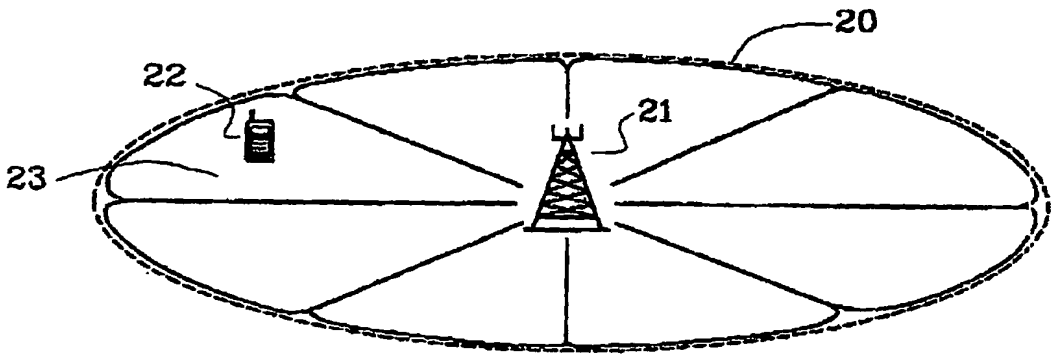

Fig. 2a

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